

REMARKS

Claim 1 has been amended to include the limitation of claim 5, i.e., to recite that a mass ratio of the wettability improving agent relative to the nonaqueous solvent of the nonaqueous electrolyte of the lithium secondary battery of the present invention is not greater than 3 mass %.

Claims 5-8 and 13-16 have been canceled.

New claims 18-23 have been added to the application.

Claim 18 corresponds substantially to claim 1 of the Submission and limits the nonaqueous solvent of the nonaqueous electrolyte of the lithium secondary battery of the present invention to a mixture of ethylene carbonate and  $\gamma$ -butyrolactone and limits the wettability improving agent to N-methylpyrrolidone (NMP).

Claim 19 corresponds substantially to claim 1 of the Submission and limits the nonaqueous solvent of the nonaqueous electrolyte of the lithium secondary battery of the present invention to a mixture of ethylene carbonate and  $\gamma$ -butyrolactone and limits the wettability improving agent to methyl formate (MF).

New claims 20-21 depend on new claims 18 or 19 and recite that the oxidative decomposition potential of the wettability improving

agent is smaller than that of the nonaqueous solvent (claim 20), that a reductive decomposition potential of the wettability improving agent is not greater than 0.0 V (claim 21), that a mass ratio of the wettability improving agent relative to the nonaqueous solvent is not greater than 3 mass % (claim 22), and that the oxidative decomposition potential of the wettability improving agent is in a range of 4.8 V to 5.2 V (claim 23).

Referring to the Action, the amendment to claim 1 to include the limitation of claim 5 renders the 35 U.S.C. § 102(b) rejection and alternative 35 U.S.C. § 103(a) rejection of claims 1-4 and 9-12 over Simon et al., U.S. Patent No. 5,626,981, and the 35 U.S.C. § 102(e) rejection and alternative 35 U.S.C. § 103(a) rejection of claims 1-4 and 9-12 over Kim, U.S. Patent Application Publication No. 2003/0073005 A1 ("Kim"), moot since claim 5 is not included in these rejections.

The only remaining rejection of the claims in the Action is of claims 5-8 and 13-16 under 35 U.S.C. § 103(a) as being unpatentable over Kim. Reconsideration and removal of this rejection, to the extent that it applies to the claims as amended, is respectfully requested for the following reasons.

First, as argued by applicants in the Submission under 37

C.F.R. § 1.114 filed September 16, 2008, the limitation in the claims that the "solute of the [nonaqueous] electrolyte is a lithium-containing salt" patentably distinguishes the lithium secondary battery of the present invention over the battery of Kim. This limitation excludes solutes other than a lithium-containing salt. On the other hand, the battery of Kim requires, as an electrolyte, a salt having an organic cation that is capable of dissolving sulfur-based positive active material and which, as described on page 2, paragraph [0028] of Kim "do not contain lithium ions."

In the present Action the Office notes that paragraph [0034] of Kim describes that "the electrolyte according to another embodiment of the present invention uses a mixture in which a solid-phase lithium salt is added to the salts [having the organic cations]." This description is not inconsistent with applicants' argument that the battery of Kim requires, as an electrolyte, a salt having an organic cation that is capable of dissolving sulfur-based positive active material. A mixture of a solid-phase lithium salt and a salt having an organic cation requires the inclusion of the salt having an organic cation and is excluded by the limitation in the claims of the present application that the solute of the

[nonaqueous] electrolyte of the lithium secondary battery of the present invention is limited to a lithium-containing salt.

Removal of the 35 U.S.C. § 103(a) rejection is required for this reason alone.

Second, Kim is insufficient to support a rejection under 35 U.S.C. § 103(a) of the claims of the present application in which the mass ratio of the wettability improving agent relative to the nonaqueous solvent is not greater than 3 mass %.

In the present invention, the wettability improving agent creates a so-called shut-down effect by decomposing by oxidative decomposition and losing its wettability effectiveness when a positive electrode potential is excessively increased by overcharging. As a result, wettability between the separator and the nonaqueous electrolyte is reduced and lithium ions cannot pass through the separator and ion exchange between the positive and negative electrodes stops and forcibly shuts down an overcharge current.

If occurrence of the shut-down effect of the separator is delayed, safety of a battery is reduced. Therefore, it is required that the wettability of the wettability improving agent be dramatically decreased. To obtain such a sudden reduction of the

wettability of the wettability improving agent, a mass ratio of the wettability improving agent relative to the nonaqueous solvent of not greater than 3 mass % is required (see paragraphs [0017] and [0018] of the present specification).

In Kim the compounds corresponding to the wettability improving agent of the present invention are used in an amount of at least 90 volume % of the solvent. Specifically, in Examples 1, 2, 3 and 4 and Reference Example 4, dimethoxy ethane (DME) and dioxolane (DOL) are used in an amount of at least 90 volume %, e.g., a volume ratio of DME/EMIBeti/DOL of 75:5:20 in Example 1. DME is described in the present application (Example 1) as a suitable wettability agent for use in the invention of the present application.

The Office suggests in the Action that it would have been obvious to one of ordinary skill in the art to reduce the mass ratio of different solvent such as dioxolane to under 3% mass ratio for the reason that discovering the optimum or workable values involve only routine skill in the art. Optimization, however, must come from within the teachings of the prior art. Nothing in Kim suggests that the amount of DME and DOL is a result-effective variable that controls the shut-down effect of a battery during

overcharging.

Moreover, the data of Table 3 of the present application demonstrate the criticalness of the mass ratio of the wettability improving agent. Such data are sufficient to rebut any prima facie obviousness alleged by the Office to be supported by Kim.

For these reasons also, the 35 U.S.C. § 103(a) rejection is not proper and should be removed.

Regarding new claim 18, NMP is neither disclosed nor suggested in Kim. The oxidative decomposition potential of NMP is 4.6 V. Therefore, NMP provides the shut-down effect of the separator at a lower potential as compared to wettability improving agents having an oxidative decomposition potential of 5 V or more. (See Table 1 and paragraph [0010]).

Regarding new claim 19, MF is not disclosed or suggested in Kim.

The remaining claims are dependent on claims 18 and 19 and are prima facie patentable for the reasons explained above.

A notice of allowability of the claims remaining in the application is in order and is respectfully solicited.

The foregoing is believed to be a complete and proper response to the Office Action dated October 21, 2008.

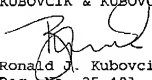
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RESPONSE UNDER 37 C.F.R. §1.111

PATENT  
NON-FINAL

In the event that this paper is not considered to be timely filed, applicants hereby petition for an appropriate extension of time. The fee for any such extension and any additional required fees may be charged to Deposit Account No. 111833.

Respectfully submitted,  
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